

## Enhancing Secondary School Students' Achievement in Geometry through Experiential Learning Approach

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### ABSTRACT

The study investigated the enhancement of secondary school students' achievement in geometry through experiential learning approach. The study was carried out in Owerri West Local Government Area of Imo State. The quasi experiment method adopting the pre-test post-test non equivalent control design was used to carry out the study. A sample of 233 senior secondary two (SS II) students from four purposively selected secondary schools was selected for the study. The data required for the study was collected through a 30-item researcher made objective test questions with reliability coefficient of 0.86 determined using Pearson's product moment correlation formula. The control group was taught geometric concepts using conventional method while the experiment group was taught using the experiential learning approach. The data generated was analyzed using ANCOVA tested at 0.05 level of significance. The result of the study revealed that experiential learning approach enhanced students' achievement in geometry across gender and achievement levels. Based on the result, it was recommended that experiential learning approach should be applied in teaching mathematics in secondary schools to enhance students' achievement.

**Keywords:** Experiential Learning Approach, Students' Achievement, Geometry.

### INTRODUCTION

Mathematics is a subject which seeks to understand patterns that permeate both the world around us and the mind within us. There are many ways of thinking and other kind of thinking one learns in mathematics. Mathematics is the ability to handle abstraction and solve problems that require knowledge of mathematics [1]. [2] described mathematics as the backbone of all scientific investigation and all activities of human development. Mathematics is very vital in the development of individuals and nations as it contributes immensely in the scientific and technological development of nation. [3] pointed that any country that aspires for growth in science and technology must not neglect mathematics. Mathematics helps in the functionality of any individual in any society as it enhances problem solving skills, intellectual ability and creativity. Mathematics has become an important social factor and that it is no longer tenable to think that mathematics is still an exotic good for only an exclusive group of people [4]. According to [5], the main goal of mathematics education is the "Mathematization" of the child's thinking clarity of thought and pursuing assumptions to logical conclusions is central to mathematical enterprise.

It becomes very worrisome that this all important subject has suffered much hatred leading to consistent poor performance over the years among students. WAEC Chief Examiner's Report in [6] confirmed the poor achievement and went on to lament that this poor achievement has resulted in

students' low interest in the subject. The poor achievement of students in Mathematics at the secondary school level is noticed in the area of geometry. [7] indicated that students fear and hate mathematics which resulted to lack interest and poor achievements in mathematics particularly geometry and measurement. Geometry as an important aspect of mathematics helps individuals

- In understanding how to deal with measurements and relationship of lines, angles, surfaces and solids.
  - To understand and have knowledge of spatial use with respect to areas related to space and the position, size and shape of things in it.
  - In creative thinking
  - To develop their ability in the use of concrete materials and activities.
  - To think logically, which is required to solve difficult problems and situations.
  - To develop ideas of construction, which is required in architecture and engineering fields.
- The importance of this aspect of mathematics does not require the level of poor achievement associated with it among students.

In most cases, the teaching approach employed by the mathematics teachers has been identified as the major cause of students under achievement in this area of mathematics. Most teachers adopt the conventional approach to teaching. The conventional approach is a traditional approach to teaching, whereby the teacher disseminates the information verbally to the students. Sometimes, the teacher writes on the chalkboard while the

students listen and take notes and ask questions for clarifications [8]

The traditional learning approach does not allow the students to be active in the classroom situation thereby not meeting the students learning needs.

The quest for improved students achievement in mathematics especially in geometry is an indication that mathematics teachers should jettison the age long and unproductive teacher centered teaching approach and seek for a more viable student centered approach such as the experiential learning approach.

Geometry as a basic and important branch of mathematics is the study of size, shape and position of 2 dimensional shapes and 3 dimensional figures [8]. Experiential learning is any learning that supports students in applying their knowledge and conceptual understanding to real-world problem or situations where the instructor directs and facilitates learning [9]. Nadler in [10] defined experiential teaching method as a type of learning in which students participate in some activities, reflect upon the activities and use their experience then incorporate their new understanding into their lives. While [11] sees it as “learn by doing approach” which enables them to find out fact and meaning about concept by themselves with the guidance of a teacher. [12] indicated that experiential learning approach asserts that acquisition of skills and construction of knowledge by the learners is direct result of experience. The learner is said to have the ability to select and to participate in experiences that will further their growth. Ajiboye and Ajitomi in [13] reported that the experiential teaching approach is based on the model designed by Kolb based on Dewey’s theory of experience. The model builds on the concepts that children learn best by being interested fully in their own work by interacting with one another, doing the tasks themselves, by puzzling themselves, by verifying their own suppositions, by experimenting and by drawing conclusions based on the strength of evidence which they have collected.

When students are exposed to experiential learning by engaging in formal, guided, authentic, real-world experiences, they:

- Deepen their knowledge through repeatedly acting and then reflecting on their action.
- Develop skills through practice and reflection

- Extend their learning as they bring their learning back to the classroom.

- Support the construction of new understanding when placed in novel situations.

[11] reported the advantages of experiential learning as follows:

- Multiple teaching (learning method) can be integrated. That is the method of interactive
- It is learner centered.
- The teaching process involves discovery which built self-esteem in learners.
- Learning is more fun for learners and teaching more fun for teachers.
- Other life skills can be learned instead of only science content.

The experiential teaching approach makes learners to be active in the classroom, self explorative, gain insight into situation, acquire problem solving skills and have self understanding and environment. Experiential teaching method embodies co-operative learning, personalized system of instruction as well as affective science teaching [10].

#### STATEMENT OF THE PROBLEM

The consistent application of the traditional approach of teaching mathematics especially the geometric concepts has proved counterproductive in terms of students’ outcome. In a society such as Nigeria where there is urgent need for students to be self reliant, independent, problem solvers and productive in a dwindling economy, it becomes pertinent to employ learning strategies that are student centered which will grant them the opportunity to be explorative.

Therefore, this study was carried out to determine how experiential learning approach will enhance students’ achievement in geometry.

#### PURPOSE OF THE STUDY

The main purpose of the study was to determine how experiential learning approach will enhance students’ achievement in geometry. Specifically, the study will determine whether:

- Secondary school students taught geometrical concept using experiential learning approach will have better achievement than those taught traditionally.
- Male and female students taught geometrical concept using experiential learning approach will differ in their achievements.

- High and low achievers taught geometry using experiential approach will differ in their achievements.

### HYPOTHESES

The following hypotheses guided the study:

- H0<sub>1</sub>: There is no significant difference between the mean achievement scores of students taught geometric concepts using experiential learning and those taught traditionally.
- H0<sub>2</sub>: There is no significant difference between the mean achievement scores of male and female students taught geometric concepts using experiential learning approach.
- H0<sub>3</sub>: There is no significant difference between the mean achievement scores of high and low achievers taught geometric concept using experiential learning approach.

### METHODOLOGY

The quasi-experimental research design was adopted in carrying out the study considering the pre-test post-test non equivalent control type.

Group	Pre-test	Treatment	Post-test
Experiment	X <sub>1</sub>	C <sub>1</sub>	X <sub>3</sub>
Control	X <sub>2</sub>	-	X <sub>4</sub>

(C<sub>1</sub> = Treatment, - No treatment)

The population of the study consists of all the senior secondary two (SS 2) students in the 12 Government owned secondary schools in Owerri West Local Government Area of Imo State. The purposive sampling technique was used to select four co-educational secondary schools. A total of two hundred and thirty three (233) students were used for the study comprising of one hundred and twenty (120) males and one hundred and thirteen (113) females. In each of the schools selected for the study, two intact classes were randomly selected and assigned to experiment and control groups respectively. The experiment group was made up of one hundred and twenty five (125) participants consisting of seventy (70) males and fifty five (55) females while the control group consists of one hundred and eight (108) participants consisting of fifty (50) males and fifty eight (58) females.

Table 1, shows that  $f$ -calculated of 306.200 is greater than the table value 3.84 also,  $P < 0.05$ . Based on the result, the null hypothesis is rejected and the alternative accepted at 0.05 level of significance.

The data required for the study was collected through a 30 item objective test questions titled Geometric Achievement Test (GAT) with options A – D constructed by the researcher and guided by a table of specification on geometric concepts taught the students. The content and face validity of the instrument was decided by a measurement and evaluation expert and two mathematics education experts. Their inputs guided the restructuring of the instrument. The reliability of the instrument was determined using test-retest approach. The instrument was administered to a group of 30 students outside the study sample who were of the same characteristics two times within two weeks. Their results were collated and analyzed using Parsons Product Moment Coefficient which gave a reliability coefficient ( $r$ ) of 0.86 which was acceptable for the study.

To carry out the study, the two groups were pre-tested to determine their cognitive readiness, after that the four research assistants who were trained for the study taught the experiment group some geometric concepts such as angles and their properties using the experiential learning approach as outlined in the lesson plan. In teaching the concept, concrete materials were applied allowing the students to manipulate them as guided by the teacher allowing them to work in small groups. They were allowed to share ideas on problem situations, test conjectures interact with the teacher when the need arose. The researcher monitored the progress of the teaching to ensure that the guide lines were maintained. The control groups were taught the same concepts using the conventional “chalk and talk” approach by their regular mathematics teachers. The exercise lasted for four weeks after which a rearranged GAT was administered on both groups as post test which was scored over 100%. The generated data was analyzed using ANCOVA statistical tool tested at 0.05 level of significance.

### RESULTS

- H0<sub>1</sub>: There is no significant difference between the mean achievement scores of students taught geometric concepts using experiential learning and those taught traditionally.

This implies that, there is a significance difference between the mean achievement scores of students taught geometric concept using experiential learning approach and those thought traditionally.

**H0<sub>2</sub>:** There is no significant difference between the mean achievement scores of male and female students taught geometric concepts using experiential learning approach.

Table 1, shows that the f-calculated value of 3.334 is less than the table value 3.84, also  $p > 0.05$ . Based on the result, the null hypothesis is upheld at 0.05 level of significance.

**H0<sub>3</sub>:** There is no significant difference between the mean achievement scores of high and low achievers taught geometric concept using experiential learning approach.

Table 1 shows that the calculated f value 0.013 is less than the table value of 3.84 also  $p > 0.05$ . Based on the result, the null hypothesis is upheld at 0.05 level of significance.

**Table 1: Summary of ANCOVA Analysis**

Source	Type III sum of squares	df	Mean Square	F	Sig.
Corrected model	32471.361	6	5411.894	61.776	.000
Intercept	24392.309	1	24392.309	278.433	.000
Covariate	54.841	1	54.841	.626	.430
<b>Method</b>	<b>26824.824</b>	<b>1</b>	<b>26824.824</b>	<b>306.200</b>	<b>.000</b>
<b>Sex</b>	<b>292.056</b>	<b>1</b>	<b>292.056</b>	<b>3.334</b>	<b>.069</b>
<b>Achievers</b>	<b>1.115</b>	<b>1</b>	<b>1.115</b>	<b>.013</b>	<b>.910</b>
Method *sex	119.244	1	119.244	1.361	.245
Method *Achiever	201.340	1	201.340	2.298	.131
Error	19798.879	226	87.606		
Total	513802.000	233			
Corrected Total	82270.240	232			

## DISCUSSION

The result of the study revealed that experiential learning approach is very effective in enhancing students' achievement in geometry. This was evident as the students taught geometric concepts using experiential learning approach had better achievement than those taught using the traditional approach. This outcome is suspected to be as a result of the nature of the approach which allowed the students to express themselves, work in small groups, develop problem solving skills, allow for equal participation, provide a good learning environment and enhance students' manipulative skills which improves achievement. This result is in line with results of [8] which showed that the use of students centered approach enhanced students' achievement, [13] which revealed that pupils taught basic science and technology with experiential teaching approach performed significantly better than their counterparts who were taught using the conventional approach and, [1] which showed that experiential learning approach has a positive effect on students' mathematical creativity. The study revealed that experiential learning approach improved students' achievement in mathematics across gender as there was no significant difference

between the mean achievement scores of male and female students taught geometric concept using experiential learning approach. The result is achieved because, the approach does not allow for learning competition, every student had opportunity to study at their own pace and interacted among themselves. This result is in line with the results of [13] which indicated that no significant difference in the mean achievement scores of male and female pupils taught basic science and technology using the experiential method and [15] which showed that sex is not a factor in students' achievement in geometry when taught using students centered approach.

Finally, the result of the study showed that experiential learning approach reduced the achievement gap between students as low and high achievers taught geometric concept had no statistical significant difference in their mean achievement scores. This result is in agreement with [10] which reported that experiential teaching method fostered higher achievement than conventional package among students.

## CONCLUSION

The result of the study revealed that the experiential learning approach is more effective than the conventional approach in enhancing students' achievement in mathematics. The experiential learning approach enhanced students' achievement in mathematics across gender and reduced the gap between different levels of achievers in mathematics.

## RECOMENDATIONS

1. Mathematics teachers should be trained on the application of experiential learning approach in teaching mathematics at secondary school level to enhance students' achievement.
2. Experiential learning approach should be adopted compulsorily in secondary schools as to enable teachers apply to in teaching.
3. Mathematics teachers should be sponsored to attend conferences, seminars and symposium as to learn more on effective teaching approaches to enhance students' achievement.

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